VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

CHENNAI

24BCE14082.

Final Assessment Test(FAT) - Apr/May 2025

Programme	**B.Tech.**	Semester	**Winter Semester 2024-25**
Course Code	**BCHY101L**	Faculty Name	**Prof. Ramachandran**
Course Title	**Engineering Chemistry**	Slot	**A1+TA1**
		Class Nbr	**CH2024250500645**
Time	**3 hours**	Max. Marks	**100**

Instructions To Candidates

- Write only your registration number in the designated box on the question paper. Writing anything elsewhere on the question paper will be considered a violation.

Course Outcomes

CO1: Understand the fundamental concepts in organic, inorganic, physical, and analytical chemistry.
CO2: Apply chemical concepts for the advancement of materials.
CO3: Analyze the principles of applied chemistry in solving the societal issues.
CO4: Evaluate the fundamental principles of spectroscopy and the related applications.
CO5: Design new materials, energy conversion devices and new protective coating techniques.

Answer any 10 Questions (10 × 10 Marks)

01. a. 5 Moles of monoatomic gas at 3 atm are expanded to 1 atm pressure reversibly and isothermally at 400 K. Calculate work done and ΔU. (5 Marks)

b. Consider a fire extinguisher in which, a gaseous system is confined to a cylinder under high pressure. Explain the thermodynamic process involved in its operation. Also, comment on ΔG and ΔS associated with it. (5 Marks)

[10] (CO1/K3)

02. a. Discuss a reaction wherein two reactants participate, but the rate depends on the change in concentration of only one of the reactants. What could be the half-life of the reaction in this case? (5 Marks)

b. Brief out heterogeneous catalysis with a suitable example and explain how the activation energy will be altered in catalysis. (5 Marks)

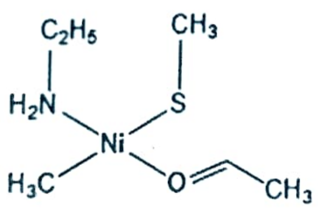
[10] (CO1/K1)

03. a. Among the complexes $Na_4[Cr(CN)_6]$ and $Na_4[CrF_6]$, identify the complex having low-energy absorption with an explanation. Deduce their CFSE and magnetic moments. (5 Marks)

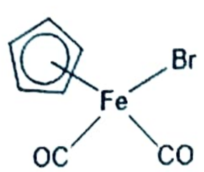
b. With proper illustration and explanation, arrange the following complexes based on the stability of their d_{xy}, d_{yz} and d_{xz} set orbitals.(5 Marks)
$[Ni(H_2O)_6]^{2+}$, $[Ni(NH_3)_6]^{2+}$ and $[NiCl_4]^{2-}$

[10] (CO1/K2)

04. a. Find out the 18 electron count in the following organometallic complexes. (Atomic Number Fe: 26 and Ni: 28) (5 Marks)



(i)

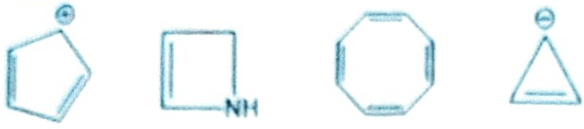


(ii)

b. Discuss any two analytical applications of coordination complexes emphasizing the reactions involved. (5 Marks)

[10] (CO1/K1)

05. a. Explain the inductive and steric effects on the stability of carbocation with suitable examples. (5 Marks)
b. Find out the type of aromaticity and stability order displayed by the following compounds with justification. (5 Marks)



(i) (ii) (iii) (iv)

[10] (CO1/K3)

06. a. With the appropriate electron delocalization structures, explain why phenolpthalein can be used as pH indicator. (5 Marks)
b. Explain the synthesis and applications of paracetamol. (5 Marks)

[10] (CO1/K1)

07. a. Illustrate the set up for electrolytic Nickel deposition on Iron with reactions involved. (5 Marks)
b. Explain the influence of atomic arrangement on the efficiency of Si-based solar cells. (5 Marks)

[10] (CO3/K4)

08. a. With the help of electrode reactions, explain the working principle of Solid Oxide fuel cell. (5 Marks)
b. What are Metal matrix composites (MMC)? Furnish any three of their applications. (5 Marks)

[10] (CO5/K2)

09. a. Compare and contrast the features of thermoplastics and thermosetting polymers. (5 Marks)
b. Explain how doping can be used to enhance the conductivity of Intrinsically Conducting Polymers (ICP). (5 Marks)

[10] (CO2/K1)

10. a. Explain the construction and working principle of UV-Visible spectrophotometer. Also, illustrate various electronic transitions possible for the following compound.

[10] (CO4/K3)

11. a. Discuss a non-destructive characterization technique widely used for identifying unknown crystalline materials. (5 Marks)
b. A sample of coal containing 4% of Hydrogen was tested in bomb calorimeter. The following data were obtained.
Wt. of coal burnt = 0.85 g, Wt. of water taken = 600 g, Water equivalent of calorimeter =2,500 g, Rise in temperature = 3.5 °C, Fuse wire correction =13.0 cal, Acid correction = 60.0 cal. Calculate gross and net calorific value of the coal, assuming the latent heat of condensation of steam as 580 cal/g. (5 Marks)

[10] (CO3/K1)

12. Describe a polymer-based chemical method which can be used to provide the residual hardness of water less than 2 ppm. Illustrate the process with a neat sketch and give the equations for the same.

[10] (CO5/K1)

BL-Bloom's Taxonomy Levels - (K1-Remembering,K2-Understanding,K3-Applying,K4-Analysing,K5-Evaluating,K6-Creating)

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